

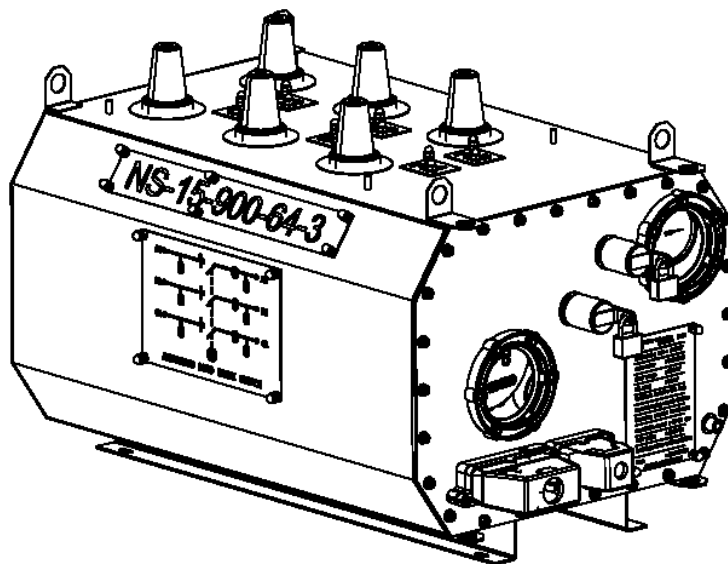
DEBA NV
ON LINE POWER TECHNOLOGIES Inc.

SU-3G
Submersible Load Break Switch

SU – 3 G

URBAN SUBMERSIBLE FAST SWITCH

15KV / 900A / 40 KA



INSTALLATION AND MAINTENANCE INSTRUCTION MANUAL

User Manual
DEBA n.v.
On Line Power Technologies
March 2008

SU-3G Urban Submersible Fast Switch

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The information given is applicable to the standard version of the SU-3G Urban Submersible Fast Switch. Therefore, Deba nv cannot be held liable for any damage resulting from specifications that differ from the standard version of the SU-3G Urban Submersible Fast Switch.

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NOTES

PREFACE

A This document

This document is intended as a reference with which qualified and trained operators can transport, install, use and maintain the SU-3G Urban Submersible Fast Switch (Submersible Switch SU-3G) in a safe and economic way.

This document's definition of "Submersible" is used to indicate a randomly occurring intermittent condition. For detail, see "General Description".

In the documentation the words "left", "right", "front" and "behind" are used to indicate a specific part of the Submersible Switch. The starting point for this is always the position of the operator, standing at the front side of the Submersible Switch.

B Safety alert's used on the Submersible Switch SU-3G

The following pictogram are used on the Submersible Switch



WARNING

Danger of high voltage

Access to the specific part of the Submersible Switch is only allowed after the unit is voltage free.



No drilling

Sealed unit. Never drill into the tank
Contained pressurized SF6 gas

C Safety alert's used in the documentation

In this installation and maintenance instruction manual of the Submersible Switch SU-3G, the following pictograms are used:



CAUTION

Procedure that can, when not carried out with the necessary care, result in damage to the SU-3G Submersible Switch, the surrounding area or the environment.



WARNING

Danger of high voltage



Notes, suggestions and advices

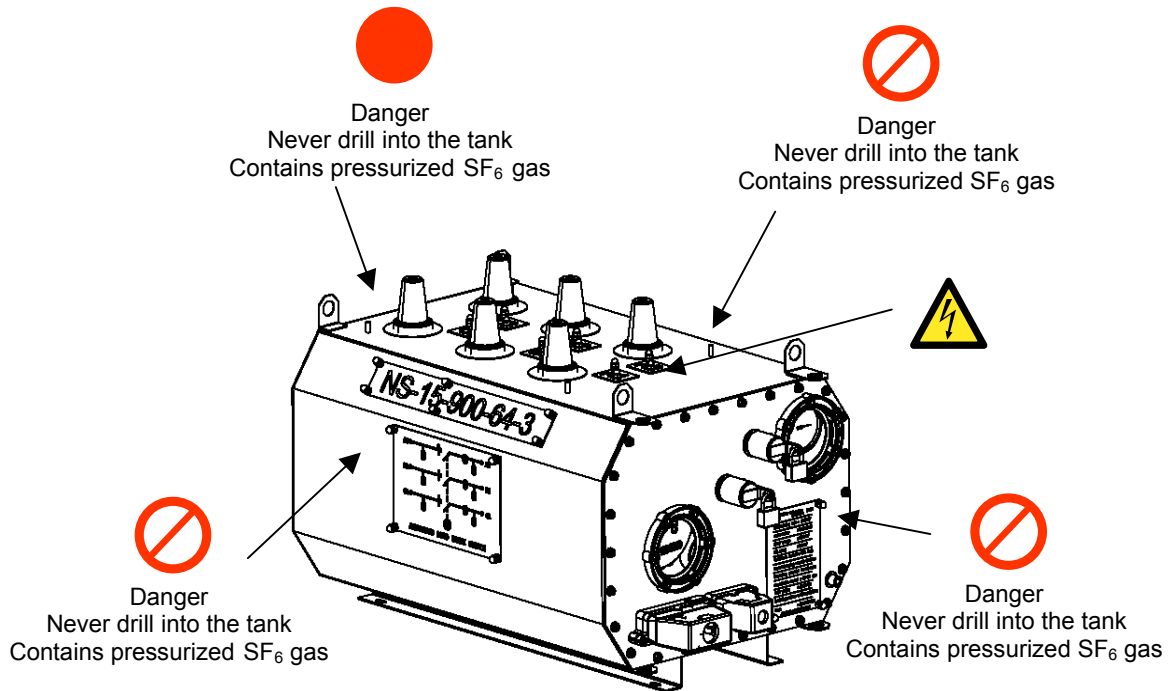


Consult the indicated information source first.

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D **Location of the safety labels on the Submersible Switch SU-3G**



E **Related documentation**

The following documentation is available for the Submersible Switch SU-3G

- Spare part list See page 35 of this user's manual
- Technical literature Reference: AG.....

F **Service and technical support**

For information concerning specific settings, maintenance or repair work that is not mentioned in this document, please contact the following companies

**Supply in the United States of
America**

On-Line Power Technologies Inc
113 Sunnyside Drive
10705 – YONKERS - NEW YORK
USA
Tel: + 1 (0) 914 968 44 40
Fax: + 1 (0) 914 968 11 66
brucehack@worldnet.att.net

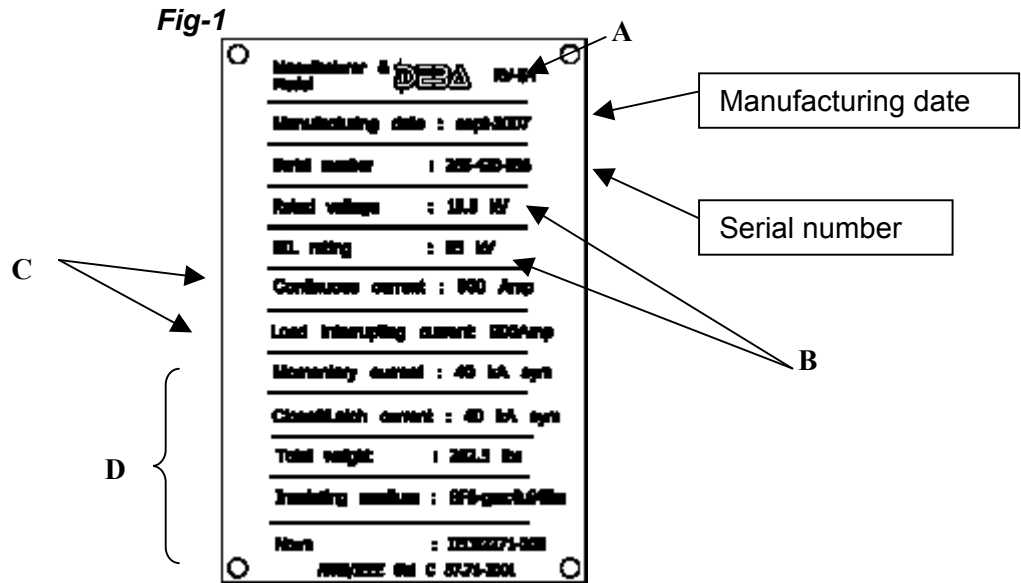
Supply in Europe

DEBA NV
Moorstraat 24
9850 – NEVELE
BELGIUM
Tel: + 32 (0) 9 371.75.51
Fax: + 32 (0) 9 371.59.25
info@deba.biz
www.deba.biz

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G Identification of the switch

Every Submersible Switch SU-3G is fitted with an identification plate containing the serial number, the type designation, the manufacturing date, the rated voltage and all other specifications:



H Identification plate and location

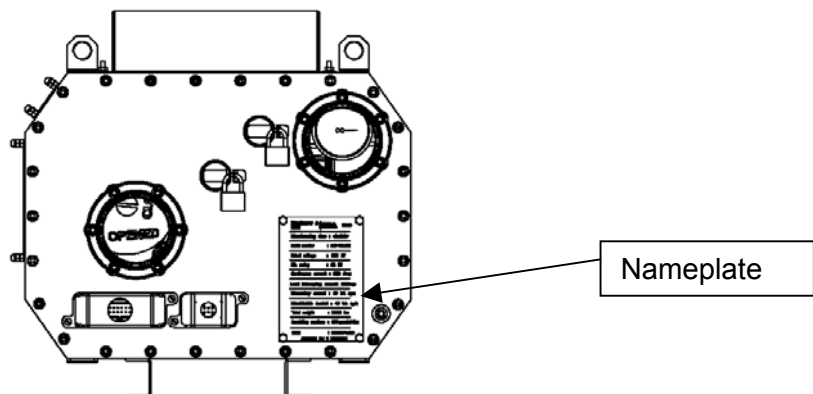
As shown here above

A – Type designation

B – Voltage Related Ratings

C - Current Related Ratings

D – All other technical specifications.



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I Serial number and manufacturing date

As a standard, the Submersible Switch SU-3G is equipped with bolted stainless steel nameplates throughout (fig-1 page 5). The Main Ratings nameplate is located on the lower right corner of the front cover of the switch. The nameplate is engraved with the serial number and the manufacturing year.

Whenever possible when contacting your Submersibles Switch SU-3G service & support center always include the following information's:

- Year of manufacturing
- Serial number

J General safety directions and instructions

Deba nv and On-Line Power Technology Inc. does not accept any liability for damage including special, indirect or consequential damages for any injury caused as a result of not (strictly) following the safety directions and instructions, or by negligence during the installation, the use, the maintenance, and or the repair of the SU-3G Submersible Switch and any accompanying options.

Depending on the specific user circumstances or switch options provided, extra safety instructions may be necessary.

Please contact your service support center immediately if you are encounter a potential danger when using the Submersible Switch SU-3G.

The Owner / Operator of the Submersible Switch SU-3G is fully responsible at all times for following all local codes, practices, utility and government requirements and proper safety directions and guidelines as well as proper maintenance as directed herein.

K User's manual

- Anyone operating or maintaining the Submersible Switch SU-3G must become intimately familiar with the contents of the user's manual and follow the directions contained therein. **Only fully trained individuals should be allowed in the vicinity of operating Submersible SU-3G switches.** No one other than fully trained individuals should be allowed to operation or attempt to maintain a Submersible Switch SU-3G.
- Never change the order of the actions to be taken as defined herein

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- Always keep the user's manual in the vicinity of the Submersible Switch SU-3G, in a safe and designated location where it can easily be referenced.

L Pictograms and safety symbols

Pictograms; symbols and instructions fitted to the Submersible Switch SU-3G are a part of the safety equipment. They may not therefore be covered or removed and must be present and clearly readable throughout the entire lifetime of the Submersible Switch SU-3G.

- Replace or repair unreadable or damaged pictograms, symbols and instructions. Immediately contact your service support center for any needs in these matters (see page 6).

M Operators

The performance of the work described (transport, installation, use and maintenance) is strictly reserved for operators trained and qualified to do so who are familiar with the dangers that can occur when using the Submersible Switch SU-3G. Temporary workers, staff and personnel in training may not operate the Submersible Switch SU-3G in any way.

N Technical specifications

- The technical specifications may not be changed
- Modification to, or replacement with any non-standard parts to the Submersible Switch SU-3G is totally not permissible.

O Transport, storage, installation, use and maintenance

Refer to the different chapters related to the concerned matter from pages 18 to 33 of this manual.

P Intended use

The Submersible Switch SU-3G is exclusively designed to be using within its defined ratings for feeder sectionalising and load transfer between various feeders and substations as well as the isolation of faulty feeder sections all to be in accordance with the specifications and conditions provided by Deba nv.

Any other use is not in conformity with the intended purpose¹

¹ "Intended use" as laid down in EN 292-1 is the use for which the technical product is suited as specified by the manufacturer-including his directions in the sales brochure. In case of doubt it is the use that can be deduced from the construction, the model and the function of the technical product that is considered normal use. Operating the product within the limits of its intended use also involves observing the instructions in the user manual.

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Deba nv and On-Line Power Technology Inc. shall accepts no liability and shall fully be held harmless for any damage or injury resulting from any inappropriate, unspecified or misapplied use of any SU-3G switch.

The Submersible Switch SU-3G is in accordance with the applicable standards and guidelines. See the technical brochure (AG.....)

Only use the Submersible Switch SU-3G in technically perfect condition, in accordance with the intended use described above.



Always keep-sealed connections (if any) intact at all times. Breaking the sealed connections irrevocably voids any claim under guarantee.

1 – GENERAL DESCRIPTION OF THE SUBMERSIBLE SWITCH SU-3G

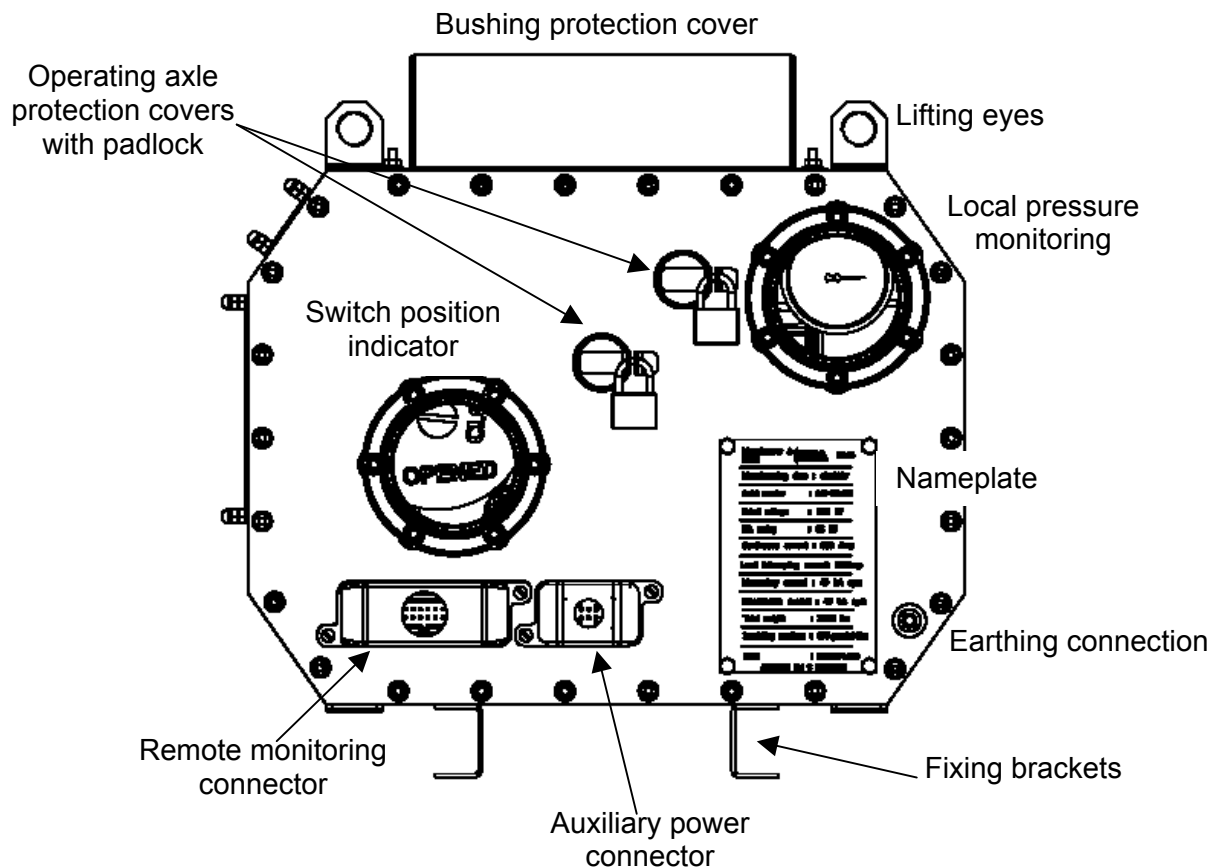
1.1 Preamble

The Submersible Switch SU-3G is to be used for sectionalising and load transfer on primary feeders on the 15 kV network. Its application is limited to locations where available fault current is a maximum of 40 kA sym.

The switch may be installed below ground level in vaults, which may on occasion become flooded to a maximum of 10 feet water.

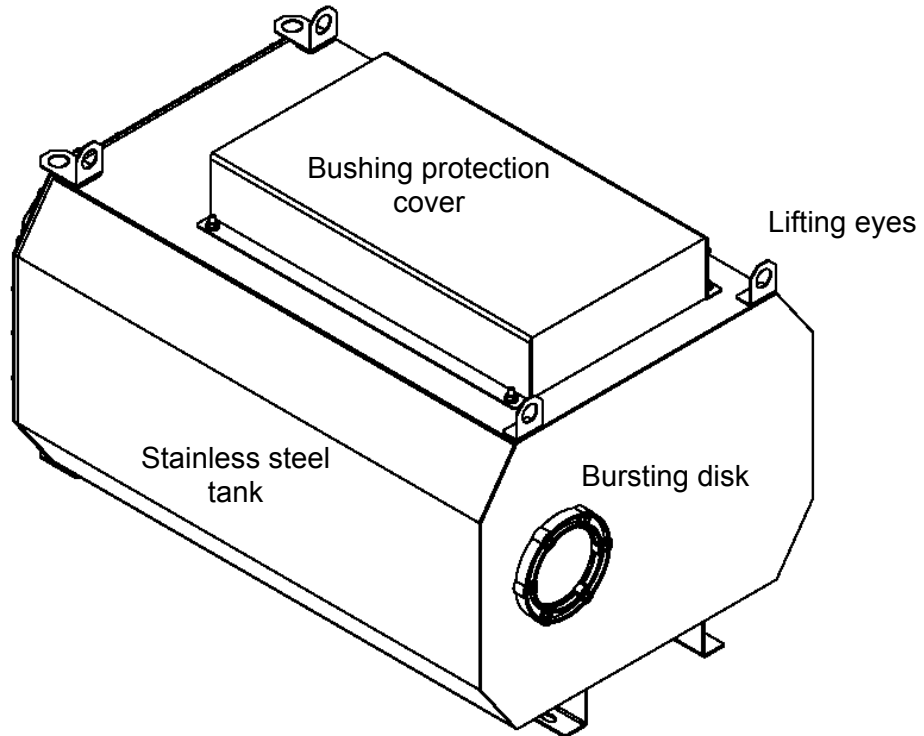
1.2 Description of the Submersible Switch SU – 3G.

1.2.1 Front view

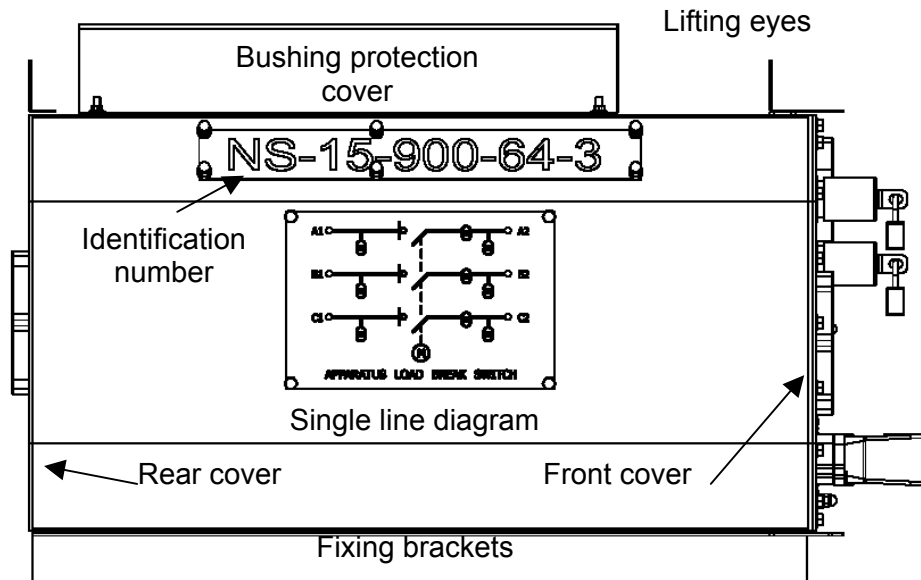


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1.2.2 Rear View

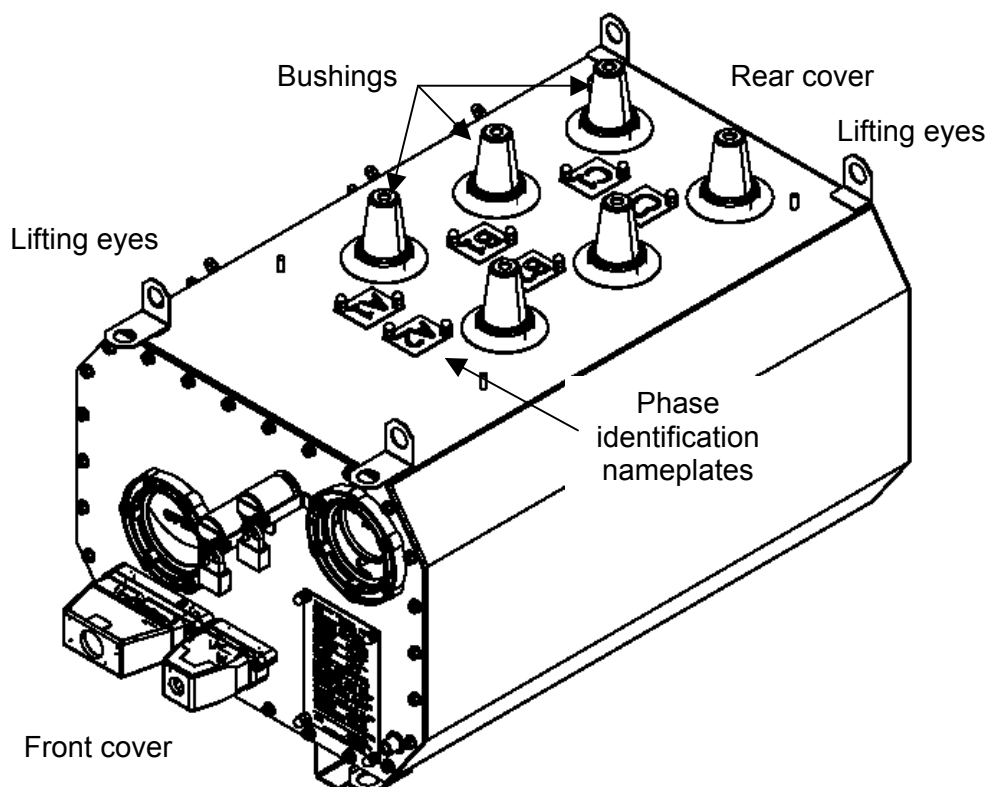


1.2.3 Side view

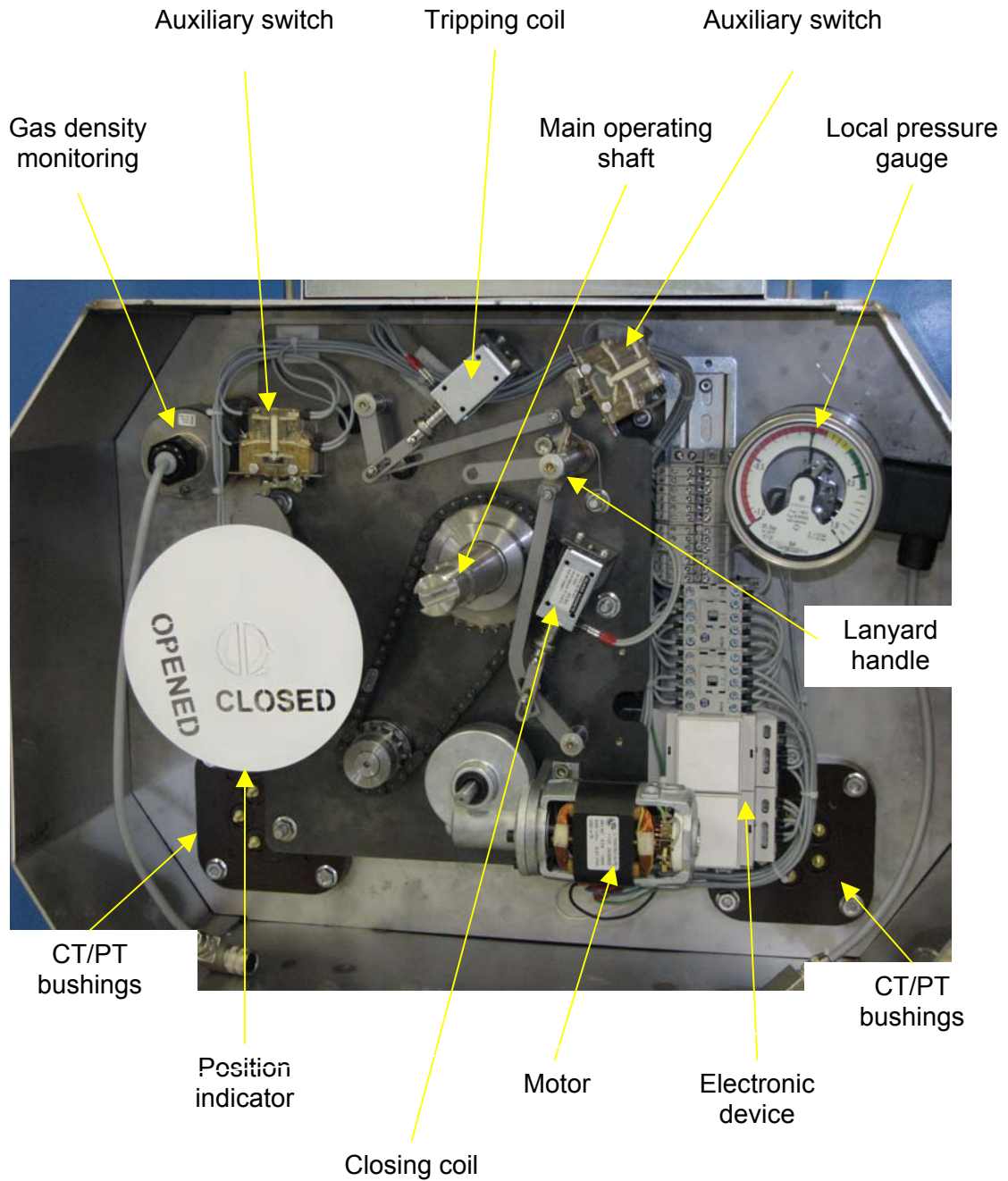


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1.2.4 3D View without bushing protection cover.

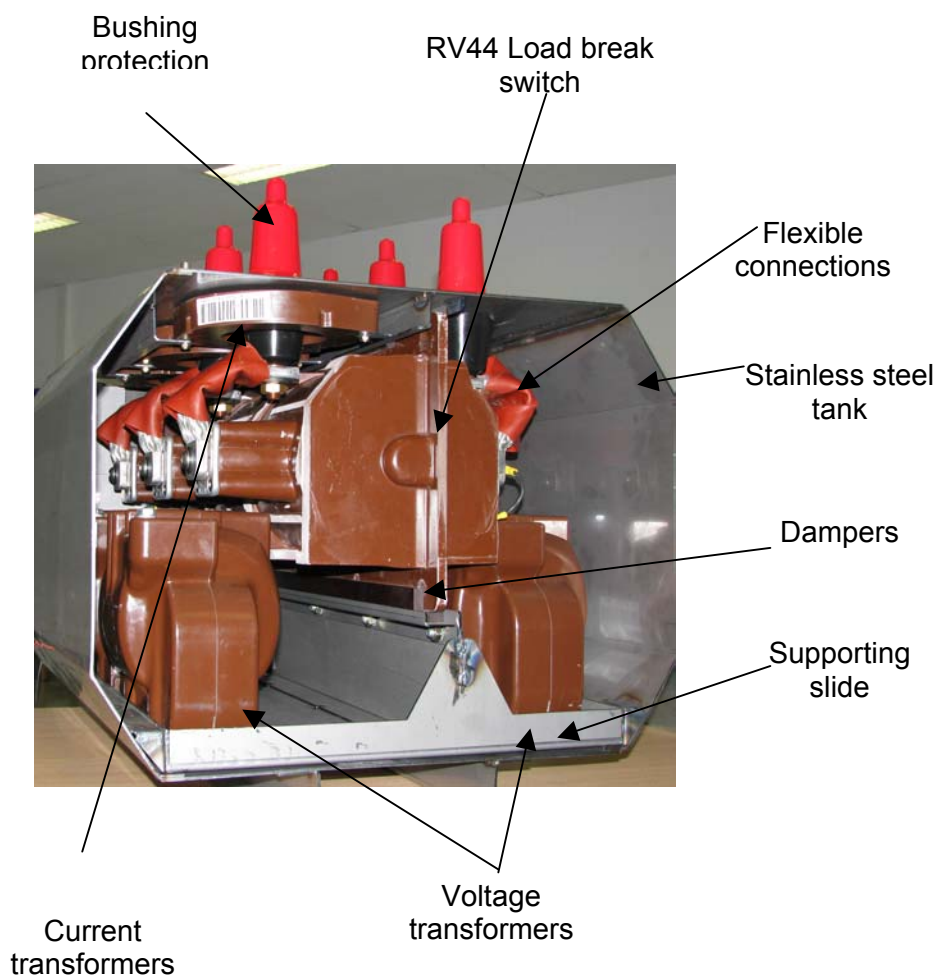


1.2.5 Mechanical spring drive – Air filled compartment



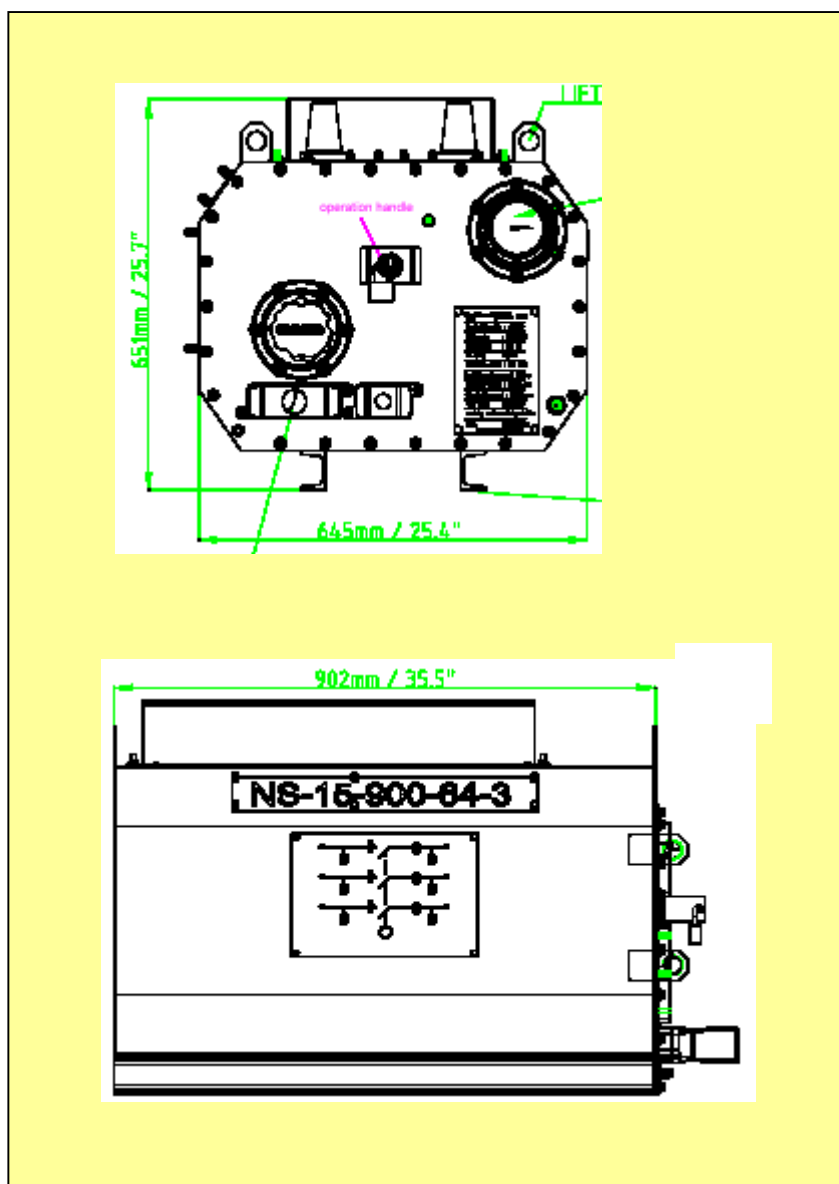
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1.2.6 SF6 insulated HV compartment



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1.3 Overall dimensions



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1.4 Technical specifications

Submersible Switch SU-3G	
Rating design voltage	15.5 kV
Rated voltage	13.8 kV
60 Hz 1 min withstand	35 kV
DC 15 min. withstand	30 kV
BIL Rating	95 kV
Continuous current	900 Amp
Load interrupting current	900 Amp
Momentary current	40 kA sym
Close and Latch	40 kA sym
	63 kA sym
	104 kA Peak
One-second current	40 kA sym
Magnetizing interruption current	21 A
Cable charging interrupting current	50 A
Make time	3 to 4 cycles
Break time	3 to 4 cycles
Total weight	262.5 lbs
Insulating medium	SF ₆ low pressure
	Sealed for life design
Ambient operating temperature	-30°C to +50°C
Related standards	IEC62271-100 ANSI/IEEE Std C37.71-2001

2 - TRANSPORT AND STORAGE

2.1 – Transport condition and incidents

The switches are shipped palletised and crated.

Upon receiving the Submersible Switch SU-3G whether for storage or immediate use; always carefully check for any shipping damage immediately upon unloading the Submersible Switch SU-3G from the carrier of conveyance.

Always check the bill of lading and compare with the ordered goods.

If any visible damage is evident at all, **IMMEDIATELY** proceed as follow:

- Immediately inform the carrier **in writing**
- **Photograph the damages** and submit to the carrier and company in the immediate sales chain.
- Ask for an inspection by the carrier
- Mark the delivery documents with inspection findings and **keep copy** for your records and those in the immediate sales chain.
- **Send an official claim to the carrier.**

If a damage is discovered after the unpacking of the switches

- Immediately inform the carrier **in writing**. Any obvious external damages noted after 15 days of the receipt of the goods and not notified as a claim on the carrier will not be considered as a warrant matter.
- **Photograph the damages** and submit to the carrier and company in the immediate sales chain.
- Ask for an inspection by the carrier
- Mark the delivery documents with inspection findings and **keep copy** for your records and those in the immediate sales chain.
- **Send an official claim to the carrier.**



The Submersible Switch SU-G is a sealed for life switch in a sealed for life stainless steel enclosure. The SU-3G drive section is located behind the bolted front cover. It is a hermitically sealed air insulated compartment **and is the only accessible part of the switch**. In the case of any damage, always immediately inform your closest SU 3G service center and never detach the cover by your own.

2.2 - Safety instructions – transport



All handling, rigging, installation and operation of the Submersible Switch SU-3G is restricted to qualified and trained operators ONLY. All locally applicable safety standards, government and private as well as the units' instruction manuals and guidelines shall be strictly followed.

The Submersible Switch SU-3G is designed to be a vault mounted device and can be transported and located in normal outdoor conditions. The unit comes as standard with a metal bushing protection cover fitted and bolted on the top of the switch. Once rigged safely into place and installation of load cables are to begin – the protective bushing cover can be removed and the bushing studs installed (see instruction for this procedure).

- Before transporting the Submersible Switch SU-3G:
 - o Ensure secure attachment of the switch to forklift, hand trolley or any other handling tool.
 - o Check that all parts are properly attached (especially the protection cover of the bushings)
- Transport them preferably in a horizontal position.
- Placing the unit in the vault through the manhole can only be made in vertical position.
- Do not place other objects or tools on the Submersible Switch SU-3G during transportation.



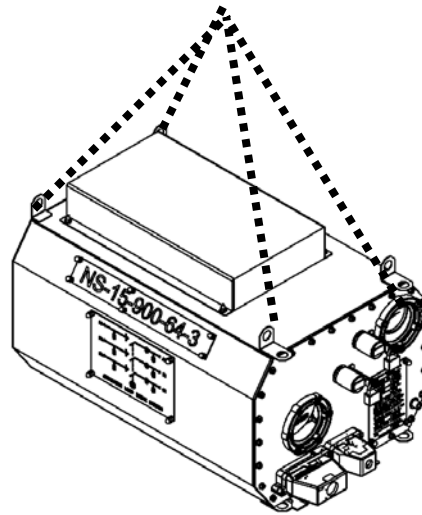
A switch that have fallen during the transportation or during the handling or have otherwise been seriously damaged must always be returned for control to the related service centre before to put the switch into operation (see page 6)

2.3 – Safety instructions - storage

- Also see the “General safety directions and instructions”
- Never stack switches on top of each other
- Store the switches – preferably – in a dry and dust free area.

3 – HANDLING

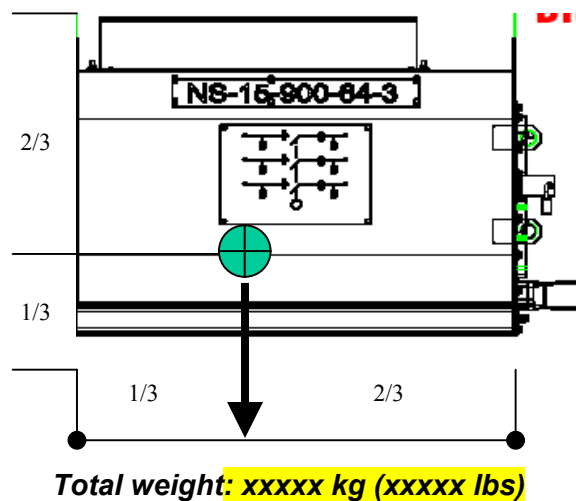
3.1 – Handling the Submersible Switch SU-3G



When handling the Submersible Switch SU-3G, observe the instructions bellow to avoid any injury or damage of the equipment.
For the lifting of the switch, use adapted hoist slings to prevent any damage to the switch during the lifting.

3.2 - Centre of gravity

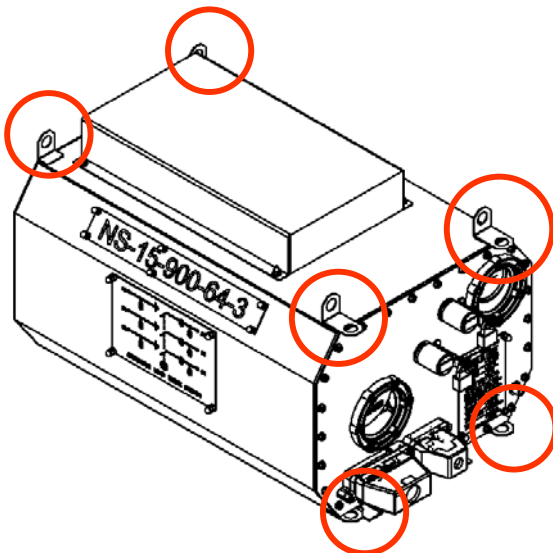
The centre of gravity is located as shown bellow:



4 – INSTALLATION OF THE SUBMERSIBLE SWITCH SU-3G AND ROUTINE TESTING

4.1 – introduction of the switch into the manhole and installation

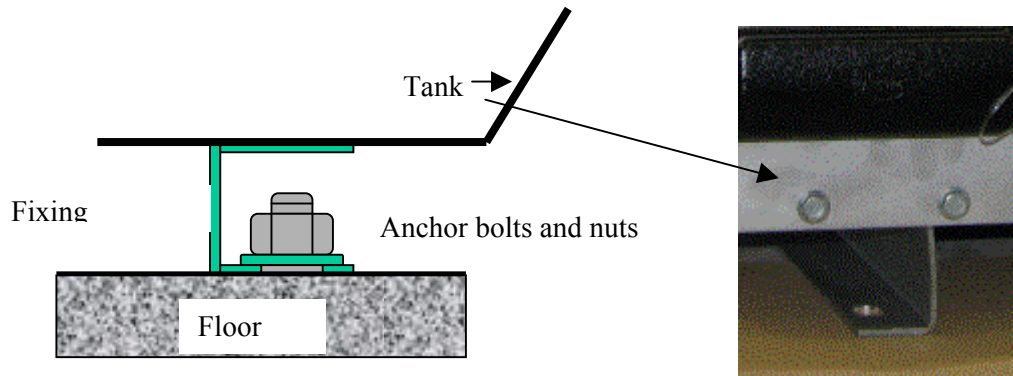
- Remove the switch from any remaining packaging or pallets by using properly rated and sized slings.
- Handle, store and disguard any packing in accordance with all local environmental health and safety rules.
- Avoid any impact or damage during this operation
- Carefully again insure that there is no visible damage on the switch. In case of any damages, please proceed as mention in 2.1 and return the switch to the closest factory authorized service center (see page 6)
- Place the switch beside the manhole or vault.
- Carefully prepare the move ahead of lifting the SU-3G. Have a safety plan in place for all eventualities.
- To lower the switch into the manhole, change the position of the hoisting slings to allow the lifting of the switch from the horizontal into the vertical position. (i.e. use the front mounted lifting eyes).
- When using the front lifting lugs always take into consideration the right length (including the depth of the manhole), size and weight of the switch.



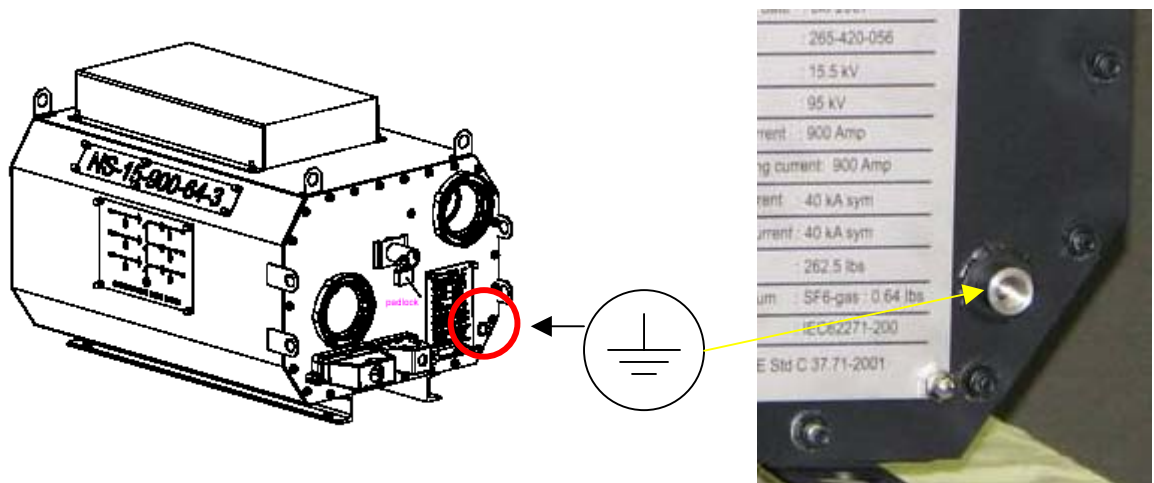
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- Once in vertical position lower the switch slowly to its final installation location.
- Always fastened the switch securely on its final mounting place with the proper anchor bolts and brackets by using the SU-3G mounting bracket boltholes.

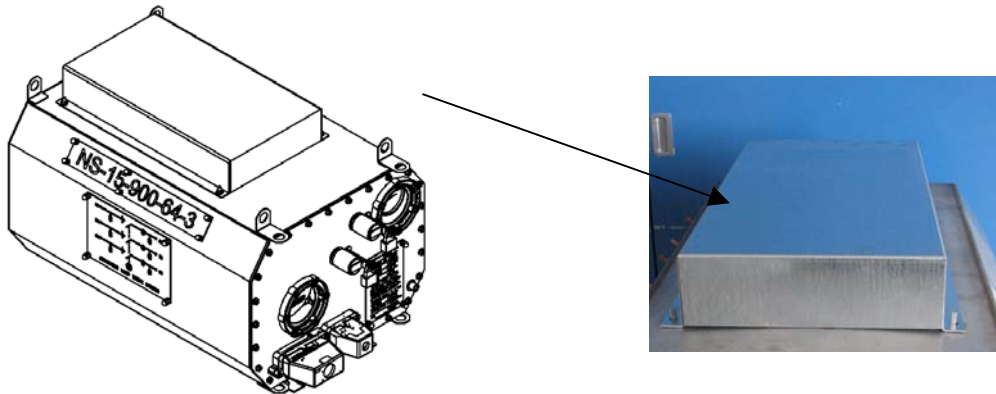


- Securely connect the grounding boss of the switch to the grounding system available in the manhole in accordance with the local utility standards.



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- Remove the shipping protection cover of the switch to allow access to the HV bushings.



- The bushings are now accessible. A plastic storage bag containing 6 protective bushing caps and bushing connector-fixing bolts is located under the bushing protective cover.



If the connection of the HV cables is to be made immediately after the placement of the switch into the vault, proceed to the cable connection of the switch.
If the cable connection will be made at a later time, place the protective caps on the bushings and store the remaining parts in a secured place.

- The Submersible Switch SU 3G is now ready for the connection of the HV cables, as well as for the connection of the LV communication and auxiliary power cables.



Any (eventual) supplementary component, that is not part of the supply of the Submersible Switch SU-3G, has to be installed by the user in accordance with the local standards and / or the manufacturer's instructions.

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4.2 - Connecting the Submersible Switch SU-3G to the HV network



The SU-3G Submersible Switch can **only** be connected to the network through elbows or straight connectors compatible with the size and type of the bushings provided in that particular SU-3G switch. The bushing type of the 900 amp SU-3G switch is: **Elastimold K675S1-CS362 short-shank model.**

Connecting the SU-3G by other method may result in serious property damage, serious personal injury and death. Using any other method voids the warranty and negates the unit's submersibility.

- Remove the shipping cover from the high voltage connecting bushings of the Submersible Switch SU-3G.
- The 6 bushings identified A1/A2 – B1/B2 – C1/C2 are visible.
- Beside each of the bushings is a plastic bag containing a rubber protection cap and the fixing stud for the cable connector.
- Remove the plastic bags and bolt the fixing studs of the connectors.



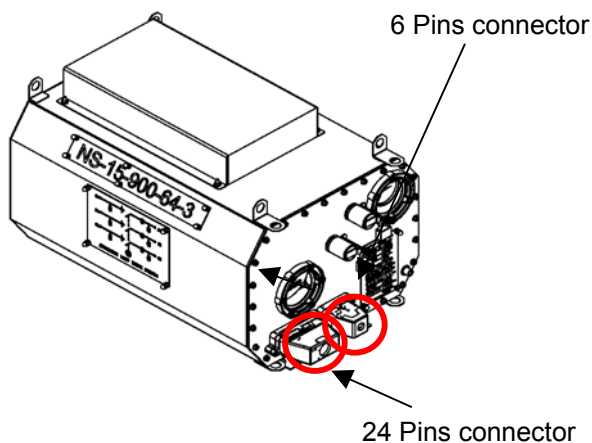
- Place the rubber protection caps in a secured place.
- Terminate the cables with the straight or elbow connectors as described in the manufacturer's procedure.
- Clean the bushings and the inside of the cable connectors with a non-fluffy clean dry cloth
- Place a thin layer of silicone grease on the bushings
- Fix the connector to the bushing with the supplied fixing components and place the Elastimold covers on the connectors.
- Connect the cable ground shields to the grounding network of the vault



Cables must be physically blocked and braced so that they do not put any mechanical stresses on the Submersible Switch SU-3G bushings neither from their cable weight nor due to fault flexing.

4.3 - Connecting the low voltage control cables

In order to allow the control, the monitoring, the communication and the feeding of the auxiliary voltage, the front cover is equipped with two LV detachable IP68 connectors.



- Left hand connector male and female insert of 24 pins
- Right hand connector male and female insert of 6 pins

The purpose of these connectors is:

- Providing the auxiliary voltage of 208 VAC from the internal switch PT's to the control cabinet
- Providing 48 VDC control power into the switches electrical operating mechanism
- The transfer of the open and close signal
- The 3 phase voltage monitoring on each side of the switch for voltage monitoring and sync check when the switch is open
- The 3 phase current monitoring
- The switch position from voltage free internal auxiliary switch
- The SF₆ density low alarm
- The SF₆ gas pressure low alarm

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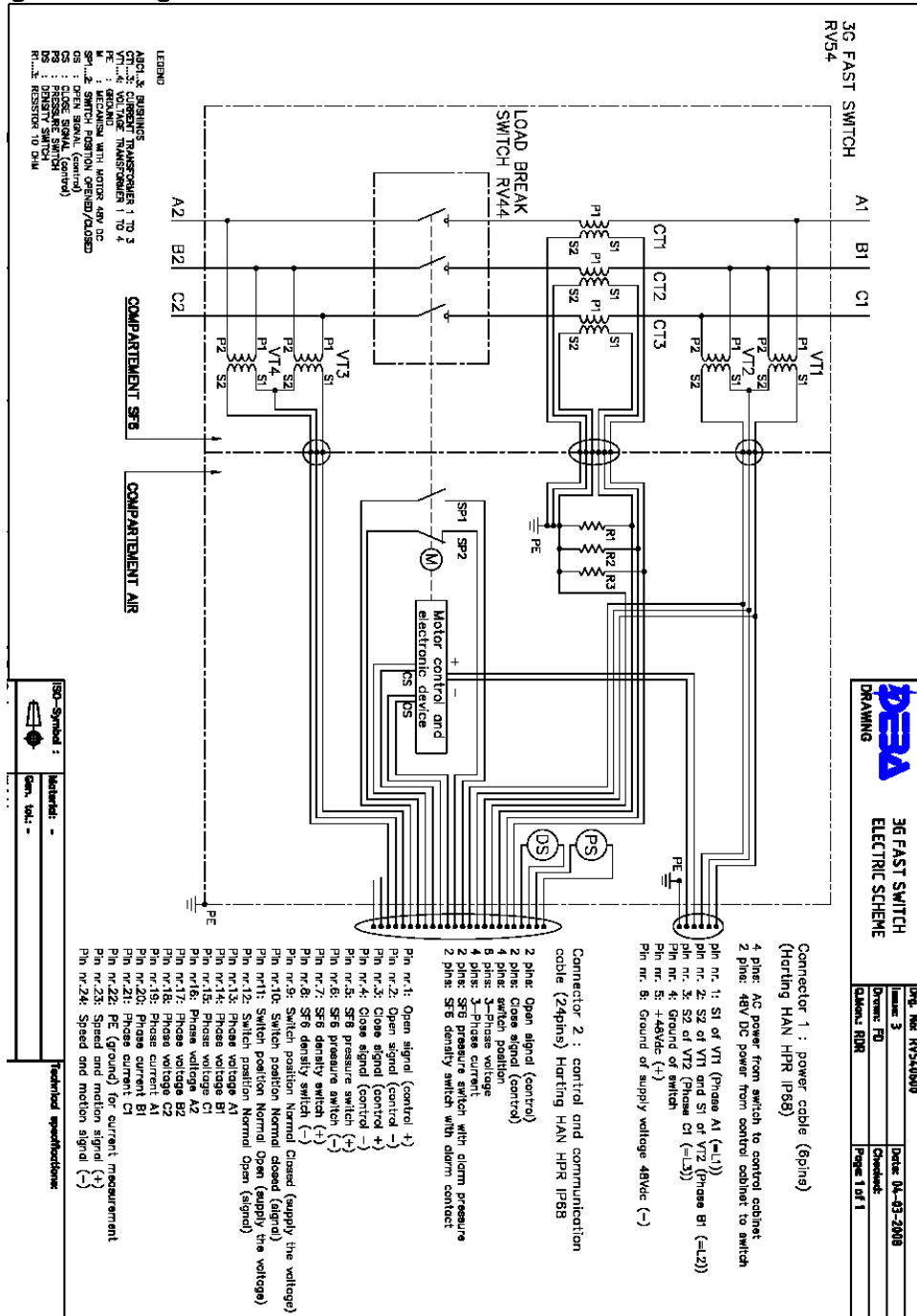
Submersible Load Break Switch

- The connectors are fitted with a 25-foot control cable adapted to the functions of each of the cables.
- One side of the cable is connected to the “Harting” plugs; the opposite side has to be connected to the appropriate points inside the control cabinet by the customer.

Contact On-Line Power Technologies or DEBA to obtain OEM control cabinet quotes

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4.3.1 Single line diagram



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4.4 – Routine Hi-Pot testing of the Submersible Switch SU-3G

- The following table indicates the values associated with the factory testing of the Submersible Switch SU-3G. Routine on site testing of a new or in service Submersible Switch SU-3G should be performed at 80% of said values.

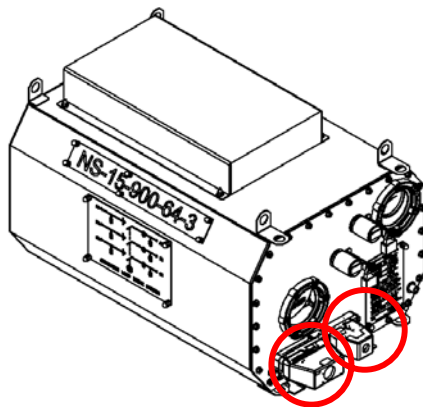
Rated voltage	Frequency	Power frequency	DC Test
15.5 kV	60 Hz	35 kV – 1' – 60 Hz	30 kV DC – 15'

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5 OPERATING THE SWITCH

5.1 – Operating the switch by the mean of the motor operated mechanical spring drive

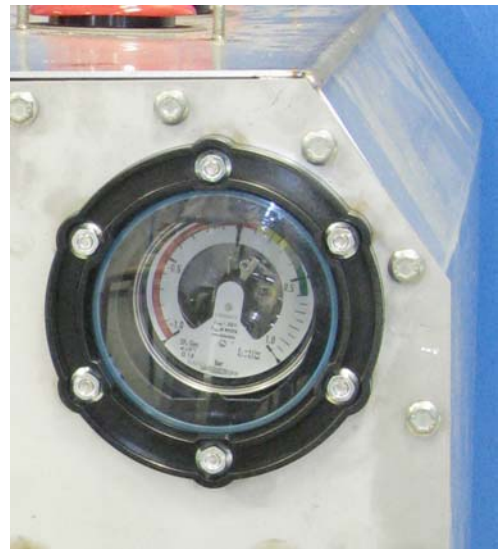
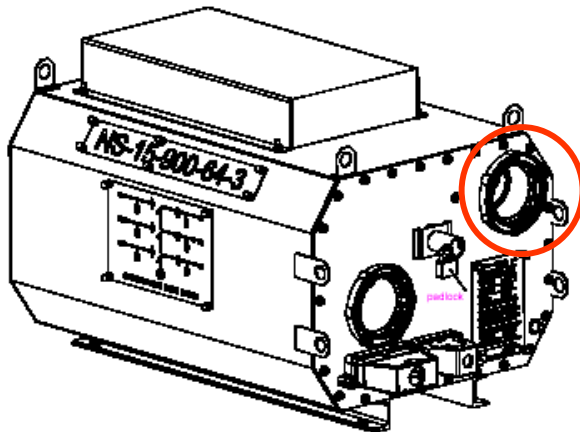
- The Submersible Switch SU-3G is a motor operated load break switch fed by an external user supplied 48VDC source (usually the optional control panel at 48 VDC).
- Connect the two control cables to the terminals.
- Connect the switch to the HV Network by means of the HV cables with straight or elbow connectors (4.2 – Connecting the Submersible Switch SU-3G to the network)
- When energized, the Submersible Switch SU-3G switch provides 208 Vac from the voltage transformers of the switch, which can feed out to a battery and charging system (usually in an optionally provided control box).
- The motor of the mechanical drive is energized via the LV control cables plugged in the connectors of the front cover.



- To close the switch electrically:
 - o Make sure the switch is charged
 - o Send an ON command via the correct pins on the connector (usually via the optional control box)
 - o The switch will CLOSE.
 - o The Submersible Switch SU-3G will annunciate the close via dry auxiliary contacts and a large semaphore flag on the front of the switch. Also the PT's will note the presence of line voltage on both sides of the switch.
- To open the switch electrically:
 - o Make sure switch is charged
 - o Send an OFF command via the correct pins on the Harting connector (usually via the optional control box)
 - o The switch will OPEN.
 - o The Submersible Switch SU-3G will annunciate the open via dry auxiliary contacts and a large semaphore flag on the front of the switch. Also the PT's will note the absence of line voltage on both sides of the switch if the switch is on a radial feeder.

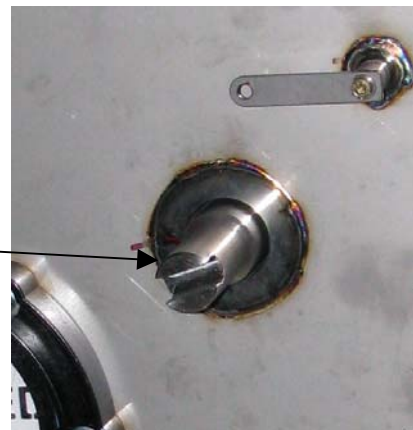
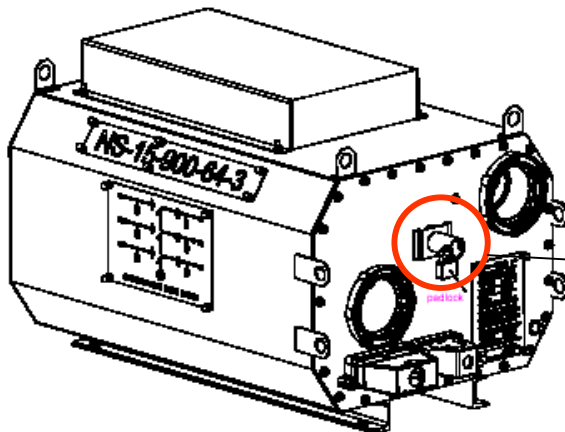


Before any local operation, always control the SF6 pressure by viewing the gauge



5.2 – Using the operating handle for charging the mechanical spring drive.

- If for any unknown reason, the motor operation of the drive does not work; it remains possible to close the switch by means of an operating handle.
- Unlock the padlock of the main shafts protection cap



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- Remove the protection cap.
- Use the operating handle and properly insert the handle on the main shaft.
- Turn the operating handle clockwise until the switch closes.
- The position indicator mention "CLOSED"
 - o The mechanism always switches independently of the operator
- Place the protection cap again on the axle
- Place and lock the padlock again



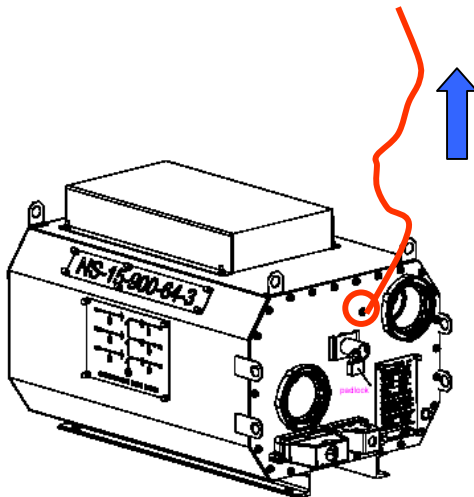
Always put the key of the padlock in a safe place. A copy of the key should be stored in the engineer's office.

5.3 – Emergency opening / closing of the switch

The switch is equipped with a (stored energy mechanism release lever). It is designed for safe out of the hole manual operation of a charged Submersible Switch SU-3G.

- Remove lock and waterproof O-Ringed cap.
- Connect a lanyard to the lever. Without applying any pressure or force on the lanyard, bring it out of the manhole. If the stored energy mechanism is charged, pulling the lanyard will release the stored energy mechanism prop latch, releasing the spring's energy and changing the state of the switch.
- Pulling the lanyard will change whatever state the charged switch in either from OPEN to CLOSE or from CLOSE to OPEN.

Always remember to snugly replace the threaded o-ringed cap. Also remember to replace any locks that may be applicable.



6 MAINTENANCE

6.1 Safety instructions – Maintenance

- Also see “General safety directions and instructions”
- The maintenance actions described are restricted to qualified and trained operators. Always observe the local applicable safety instructions and guidelines.
- All other, not indicated maintenance tasks are restricted to trained and qualified personnel.
- Ensure that the unit is voltage free before to carry any maintenance action.
- Put the switch back in service after all tools have been removed and the unit again correctly connected to the network and to the control panel.

6.2 Maintenance – General

The SU-3G Submersible Switch has been design to operate problem free with a minimum of maintenance. To guarantee this, a few simple maintenance and cleaning actions are necessary.

The maintenance intervals should be instituted based on frequency of operation and the environmental conditions in which the switch resides.

Exceptions to this are the following tasks:

- Every two years
 - o Make the entire switch voltage free and isolate from the network
 - o Remove the straight or elbow connectors
 - o Remove the LV “Harting” connectors
 - o Remove the axle protection cap padlock
 - o Remove the axle protection cap
 - o Operate the switch with the operating handle by turning the handle clockwise.
 - o Check the position indicator – Position “CLOSED”
 - o Open the switch by means of the string on the tripping handle
 - o Check the position indicator – Position “OPENED”
 - o Repeat this operation about 5 to 10 times.
 - o Remove the operating handle
 - o Place the axle protection cap
 - o Lock the padlock
 - o Clean the outside of the tank with a non-fluffy cloth and a non corrosive cleaning agent.
 - o Clean carefully the bushings with a clean non-fluffy dry cloth
 - o Place a thin layer of silicone grease on the bushings



The cleaning of the bushings should be done with isopropyl alcohol (UN Number 1219 – Formula C₃H₈O) with exception of any other chlorous solvent

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- o Clean the inside of the straight or elbow connectors with a clean non-fluffy dry cloth
- o Connect the unit to the network by fixing the straight or elbow connectors on the bushings
- o Connect the cable earthings
- o Plug both "Harting" LV connectors
- The unit is again ready to operate.

6.2.1 General checking actions

- Regularly carry out a thorough, general visual inspection
- Check that the cables are still properly fixed

6.2.2 SF₆ Pressure indicator

The switch is equipped with two SF₆ pressure indicators:

- Local pressure indicator showing the safe operation range of the switch
- Low density sensor for remote indication

The remote indicator will always indicate pressure failure

Before to re-energize the switch insure that the local pressure indicator is on the safe operation range.

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7 SUBMERSIBLE SWITCH SU-3G AND THE ENVIRONMENT

7.1 Packing material

- The packing material consists of
 - o Untreated wood
 - o Plastic straps
 - o Plastic film protection
- Contact the local cleansing department for the details of recycling or an environmental friendly way of processing the packing materials
- Tender the packing material as instructed (separated)

7.2 Disposal of the switches

With a view of the re-use of electrical components the SU-3G Submersible Switch filled with SF6 gas (Sulphur Hexafluoride) could be returned to Deba nv at the end of the their life or when damage after a common agreement.

Therefore contact your service centre.

If this is not possible the switch must be processed in an environmental friendly way.

8 LIST OF AVAILABLE COMPONENTS AND SPARE PARTS

8.1 Mechanical drive compartment

8.1.1 Important remark

The mechanical drive compartment with all covers and seals properly in place and secured, is designed as a watertight compartment.

The multi-bolt O-ring gasketed front cover is removable to allow access to the electro mechanical drive compartment and all its components

*Access during the Warranty period **Must** be performed by an Authorized DEBA or On Line Power Technologies service center only.*

Should after warranty access to the electro mechanical drive compartment, for whatever reason, be desired the front cover has to be unbolted.

*After any intervention into the mechanical drive compartment, the sealing "O ring" **MUST** be replaced with a new O-ring gasket and the cover bolts tightened in a symmetrical manner with extreme care.*

Accessing the drive compartment by any entity other than an authorized service center will void all warranties.

It is strongly recommend that an Authorized Service Center of DEBA or On Line Power Technologies ONLY accomplish maintenance beyond switch inspection and exercising.

1	Mechanical drive type DP-A-M-MEC	DP
	Mechanical drive type DP-A-M-MEC with electronic device	DP
2	Closing coil (*)	(nieuwe spoelen niet DF)
3	Tripping coil (*)	(nieuwe spoelen niet DF)
4	Auxiliary contacts	
	Motor cut off relay (*)	
5	Local pressure gauge	OP
6	Gas density monitor	OP
7	LV rail type connectors	OP
8	Motor and associated gear box	
9	Operating handle	DF045600
10	Electronic synchronisation device	
11	Spring charge shaft or lanyard water sealed protection cover	

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12	Padlocks for spring charge and lanyard water sealed protection cover	
13	Front cover window for position indicator and/ or local pressure gauge	
14	Instruction manual	
15	Bushing protection caps	
16	Metal bushing protection cover	
17	Threaded bushing studs	
18	IP 68 - 24 pins fixed male connector	
19	IP 68 - 24 pins detachable female connector and 25 feet control cable	
20	IP 68 - 6 pins fixed male connector	
21	IP 68 - 6 pins detachable female connector and 25 feet power cable.	
22	IP 68 protection cover for 24 pins fixed male connector.	
23	IP 68 protection cover for 6 pins fixed male connector.	
24	IP 68 protection cover for 24 pins detachable female connector	
25	IP 68 protection cover for 6 pins detachable female connector.	
26	10 Ohm resistance for CT secondary	

(*) Auxiliary voltage to be precised

